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DISPLAY PANEL ASSEMBLY STRUCTURE

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Claim

A type of display panel assembly structure characterized by the following facts: the display panel is fixed by bonding to a holder attached to a device case; one end of a carrier

ribbon an IC chip for the driver that drives said display panel is bonded to the connecting terminals of said display panel; and the upper surface of said holder projects above the upper surface of said display panel at the periphery of said display panel.

Detailed explanation of the invention

Industrial application field

The present invention pertains to a type of display panel assembly structure in an electronic device having said display panel.

Prior art

In an electronic device with a display panel, it is necessary to make electrical connections of the display panel to the circuit board while the display panel is attached to the device case.

In the prior art, the display panel and the circuit board are kept in a holder while they are superimposed on each other via an inner connector between them, and the holder is then attached to the device case by means of screws. The interconnector used in this case is a square bar shaped element consisting of electroconductive rubber and insulating rubber arranged alternately. It is included between the connecting terminal of the display panel and the connecting terminal of the circuit board, and serves to make electrical connections between the display panel and the circuit board. Also, there are several schemes in which an interconnector is included between the display panel and the circuit board, and they are assembled and attached to the device case by means of a holder. In one scheme, the display panel, interconnector, circuit board and holder are assembled sequentially. In another scheme, engagement pieces are provided on the holder beforehand, and after the interconnector is fixed between the display panel and the circuit board, the holder is attached to the device case.

Problems to be solved by the invention

In the display panel assembly structure of the prior art, however, because a square bar shaped interconnector is included between the display panel and the circuit board, the structure is thicker by the dimension of the interconnector. As a result, the installation space becomes larger, and this is undesirable. In the method in which the various members are sequentially assembled on the device case, when interconnector is set between the connecting terminal of the display panel and the connecting terminal of the circuit board, the assembly operation becomes very difficult because it is impossible to see the interconnector. This is undesirable. On the other hand, in the method in which engagement pieces of the holder are used to fix the display panel, interconnector and circuit board beforehand, the structure becomes even thicker due to the engagement structure, and because the circuit board is also kept in the holder together with the

display panel, the structure of the holder changes when the structure of the circuit board is changed even when the structure of the display panel remains the same, and finally, the attachment state of the holder with respect to the device case is changed. As a result, design of the device case cannot be performed before establishment of the structure of the holder. This is undesirable. In addition, in any of those assembly methods, since the display panel is placed in tight contact with the device case, the display panel may be damaged by impacts or the like, so that a space is arranged between the display panel and the device case by installing a spacer or the like, so that the number of parts and the assembly man-hours increase. This is undesirable.

The purpose of the present invention is to solve the aforementioned problems of the prior art by providing a type of display panel assembly structure characterized by the fact that it is possible to reduce the installation space and to perform the assembly, and it is possible to determine the structure of the holder irrespective of the structure of the circuit board, and it is possible to achieve a high impact strength without increasing the number of parts and the assembly man-hours.

Means for solving the problems

The present invention provides a type of display panel assembly structure characterized by the following facts: the display panel is fixed by bonding to a holder attached to a device case; one end of a carrier ribbon having an IC chip for the driver that drives said display panel is bonded to the connecting terminal of said display panel; and at the periphery of said display panel the upper surface of said holder projects above the upper surface of said display panel.

Operation

According to the present invention, electrical connections between the display panel and the circuit board are made via a carrier ribbon thinner than the square bar-shaped interconnector used in the prior art. Consequently, it is possible to reduce their installation space. Also, it is necessary to bond only one end of the carrier ribbon to the connecting terminal of the display panel. Consequently, the assembly operation becomes easier. In addition, because the display panel is fixed by bonding to the holder, it is possible to select the structure of the holder irrespective of the structure of the circuit board. At the same time, the carrier ribbon having a driver IC chip for driving the display panel is directly bonded to the display panel, so that the entirety can be modularized, and it can have the versatility for use with various types of device cases. In addition, because the upper surface of the holder projects beyond the upper surface of the display panel at the periphery of the display panel, it becomes possible by adhering the projecting surface to the device case to provide a space between the display panel and the device

case without using a spacer or the like. Consequently, it is possible to achieve high impact strength without an increase in the number of parts and the assembly man-hours.

Application examples

In the following, the present invention will be explained in more detail with reference to application examples.

Figures 1 and 2 illustrate the main portion of the display panel assembly structure in an application example of the present invention.

In this display panel assembly structure, a modular structure is formed from liquid crystal display panel (1), holder (2), carrier ribbon (3) and flexible connector (4). The liquid crystal (13) in said liquid crystal display panel (1) is sealed and accommodated between two glass substrates (11), (12) by means of sealing member (14). The structure has connecting terminal (15) arranged on the lower surface of the end portion of upper glass substrate (11).

Holder (2) is formed from a synthetic resin. A flat rectangular recess in the upper surface at nearly the central part of holder main body (21) serves as the liquid crystal display panel installation area (22). Upper ribbon accommodating area (23) is formed at the prescribed location on the upper surface of holder main body (21) as a continuation of said liquid crystal display panel installation area (22). Attaching piece (25) having a screw insertion through hole (24) is provided at the upper portion of each of the four corners of holder main body (21). Leg portion (26) is provided at the lower portion of each of the four corners of holder main body (21). Lower ribbon accommodating area (27) is provided in the lower surface of holder main body (21). At the prescribed location in said lower ribbon accommodating area (27), IC chip accommodating area (23) is provided in this structure. The depth of liquid crystal display panel installation area (22) is greater than the thickness of liquid crystal display panel (1). Consequently, upper surface (29) (including the upper surface of attachment piece (25)) of holder main body (21) at the periphery of liquid crystal display panel installation area (22) protrudes a little above the upper surface of liquid crystal display panel (1) installed in liquid crystal display panel installation area (22).

Carrier ribbon (3) comprises ribbon main body (31) made of a resin film. A lead pattern of metal foil is formed on the lower surface of ribbon main body (31). As a result, lead fingers (33) are formed projecting in opening (32) formed in the central portion of ribbon main body (31). Also, connecting terminals (34) are arranged on one end of ribbon main body (31). Connecting terminal (36) in bridge form is provided in openings (35) formed in the two ends of the other end portion of ribbon main body (31). Bump electrodes (38) of IC chip (37) are bonded to said lead fingers (33) by hot pressing. This bonding portion is sealed with sealing member (39) made of a resin.

Ribbon main body (31) is in the shape of a flat sheet before assembly. In the assembly operation, as will be explained later, it is simply bent at two prescribed locations. Consequently, linear openings (41), (42) (see Figure 1) are formed at the two prescribed locations on ribbon main body (31) from one side across the entirety to the other side. At these openings (41), (42), a connection is realized only by means of bridging leads (43), (44).

Flexible connector (4) is prepared by forming a lead pattern made of metal foil on the upper surface of base film (51) made of a resin film, and insulating layer (52) is formed except over one portion. As a result, connecting terminals (53) are provided at the site corresponding to connecting terminals (36) of carrier ribbon (3). Also, connecting terminals (54) are provided on one end portion, and the structure has cover film (55) formed continuously at the prescribed location on of base film (51). Connecting terminals (54) are connected to the controller portion accommodated in the device case. Also, solder plating (not shown in the figure) is applied to connecting terminals (53). When solder plating is applied to connecting terminals (36) of carrier ribbon (3), gold plating is applied to connecting terminals (53). These connecting terminals (53) and (54) are not covered by insulating layer (52), and they are exposed to the outside.

In the following, an explanation will be given regarding the situation when the aforementioned members are modularized.

In this case, first of all, connecting terminals (34) at one end portion of flat ribbon main body (31) of carrier ribbon (3) are bonded via anisotropic adhesive film (61) to connecting terminals (15) of liquid crystal display panel (1). Said anisotropic adhesive film (61) is prepared by nearly homogeneously mixing electroconductive particles in an adhesive. When hot pressed, connecting terminals (34) of ribbon main body (31) are bonded, with electrical connection, to connecting terminals (15) of liquid crystal display panel (1). One may also use solder or the like for bonding instead of said anisotropic adhesive film (61).

Then, the upper surface of base film (51) of flexible connector (4) is superimposed on the lower surface of flat ribbon main body (31) of carrier ribbon (3), and connecting terminals (36) of ribbon main body (31) and connecting terminals (53) of base film (51) are bonded to each other via solder plating applied to connecting terminals (53). As a result, liquid crystal display panel (1), carrier ribbon (3), and flexible connector (4) are integrated. One may also adopt a scheme in which liquid crystal display panel (1) and carrier ribbon (3) are bonded after bonding between carrier ribbon (3) and flexible connector (4) is performed.

Then, while the portion of ribbon main body (31) of carrier ribbon (3) with connecting terminals (34) is accommodated in upper ribbon accommodating area (23) of holder (2), the lower surface of lower glass substrate (12) of liquid crystal display panel (1) is bonded to the inner surface of holder (2), that is the bottom portion of liquid crystal display panel installation area (22), with double-sided adhesive tape (62). Then, while ribbon main body (31) of carrier

ribbon (3) is arranged along the prescribed side surface of holder (2), leads (43), (44) in the two openings (41), (42) of ribbon main body (31) are bent at the upper end edge and lower end edge of the prescribed side surface of holder (2). Then, while ribbon main body (31) positioned on the lower surface of holder (2) is accommodated in lower ribbon accommodating area (27) of holder (2), IC chip (37) is bonded with double-sided adhesive tape (63) and is accommodated in IC chip accommodating area (28). Also, the prescribed site of the upper surface of base film (51) of flexible connector (4) is bonded via double-sided adhesive tape (64) to the lower surface of holder main body (21) of holder (2), and cover film (55), which has been bent with respect to base film (51) beforehand, is bonded with double-sided adhesive tape (65) on ribbon main body (31) arranged along the prescribed side surface of holder (2). Also, ribbon main body (31) may be bonded via double-sided adhesive tape on lower ribbon accommodating area (27). This operation should be performed while holder (2), which has liquid crystal display panel (1) bonded to it, is turned over. In this case, because the upper surface of holder main body (21) protrudes beyond the upper surface of liquid crystal display panel (1), the upper surface of liquid crystal display panel (1) is not pressed against the operation table during the operation, so that it is possible to prevent damage to liquid crystal display panel (1), and the operation can be performed with high efficiency.

In this way, liquid crystal display panel (1), holder (2), carrier ribbon (3) and flexible connector (4) are modularized. When the module is assembled in the device case (not shown in the figure), while upper surface (29) including the upper surface of installing pieces (25) of holder (2) is adhered to the device case, the screws (not shown in the figure) inserted through screw insertion through holes (24) of holder (2) are screwed into the threaded holes formed in the device case, so that the module is attached on the device case. Then, when soldering or insertion is performed to connect connecting terminals (54) of flexible connector (4) to the connecting terminals of the circuit board (not shown in the figure) itself or to the connecting terminals of another circuit board separate from the circuit board, liquid crystal display panel (1) is electrically connected to the circuit board via carrier ribbon (3) and flexible connector (4).

In this application example, if the structure permits ribbon main body (31) of carrier ribbon (3) to fulfill the roles of the connecting terminals (54) of flexible connector (4), it is possible to eliminate flexible connector (4), so that the installation space can be further reduced.

Effects of the invention

As explained above, according to the present invention, compared with the conventional square bar shaped interconnector in the prior art, a thinner carrier ribbon is used between the display panel and the circuit board to realize electrical connection between them. Consequently, it is possible to reduce the installation space of the parts, and one may simply bond one end of

the carrier ribbon to the connecting terminals of the display panel, so that the installing operation becomes easier. Also, since the display panel is bonded to fix it on the holder, it is possible to select the structure of the holder irrespective of the structure of the circuit board. Consequently, even when the structure of the circuit board is changed, there is no need to change the structure of the holder as long as the same display panel structure can be adopted. Finally, there is no need to change the holder attachments to the device case. Consequently, when there are changes in the design of the device case, there is no restriction on the specific time when the design can be performed. In addition, because a carrier ribbon having a driver IC chip for driving the display panel is directly bonded to the display panel, everything can be modularized, so that the unit has versatility in use with various types of device cases. In addition, because the upper surface of the holder projects beyond the upper surface of the display panel at the periphery of the display panel, by adhering the projecting surface to the device case it becomes possible to leave a gap between the display panel and the device case without using a spacer or the like. Consequently, the impact strength can be increased without an increase in the number of parts and assembly man-hours.

Brief description of the figures

Figure 1 is a cross section illustrating the main portion of the display panel in an application example of the present invention. Figure 2 is an exploded view of the display panel assembly structure.

1	Liquid crystal display panel
2	Holder
3	Carrier ribbon
4	Flexible connector
15, 34	Connecting terminals
29	Upper surface of the holder
37	IC chip

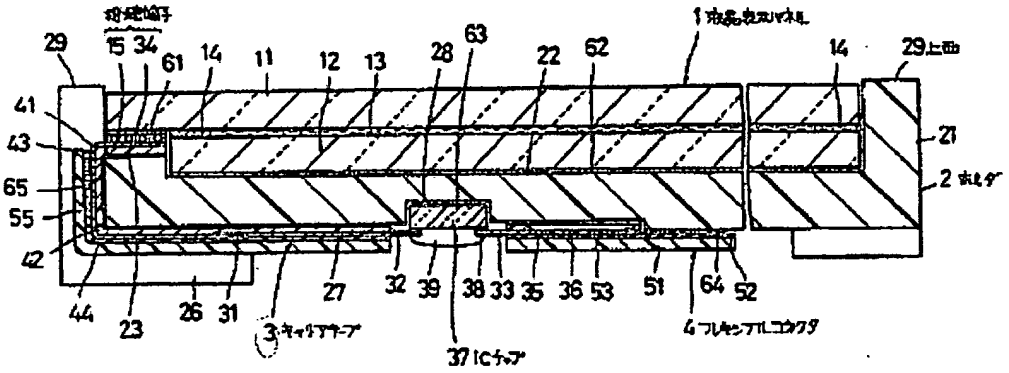

Figure 1

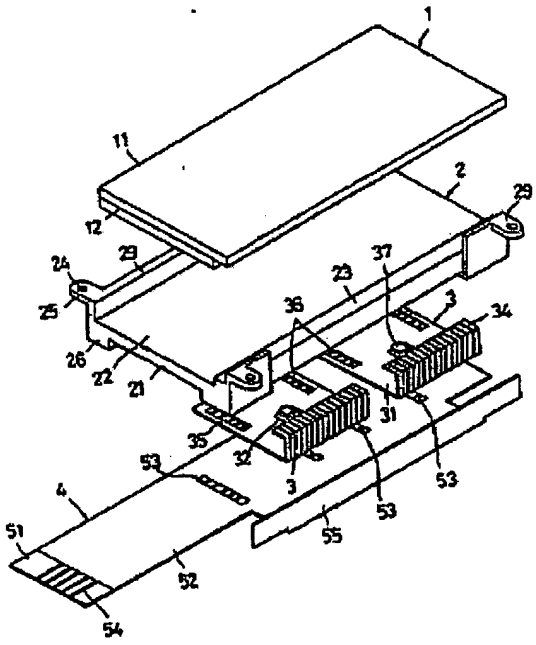

Figure 2